THE SURGICAL TREATMENT OF TUBERCULAR CERVICAL LYMPH-NODES.

A STUDY OF ONE HUNDRED CASES SUBMITTED TO OPERATION.

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THE treatment of " scrofulous neck swellings" is as old
as the history of medicine. Innumerable methods have been
devised, and many of them are still in use. Recovery follows
in a large percentage of the cases, and the treatment under
which each recovery comes is sure to have its advocates. Dur-
ing the last two or three decades, however, as surgical tech-
nique has improved, the surgical removal of the enlarged nodes
has steadily increased in favor, and is now recommended, as
the method of choice, by a very large number of our prominent
authorities. There is, however, a wide-spread feeling of un-
certainty about the late results of operation, and there are
many differences of opinion as to just what patients should
be operated upon and just what kinds of operations should
be done.

STUDY OF PUBLISHED STATISTICS CONCERNING THE COURSE OF THE DISEASE AND THE RESULTS OF TREATMENT.

The literature of this subject is very extensive and con-
tains a vast fund of information. It is based largely on re-
ports from European clinics which have been made after the
examination of patients who had previously been operated
upon. To review it in full would carry this paper beyond the
bounds of periodical publication. There are, however, certain
deductions which particularly impress one who studies it,
among which I will mention three.

1. The disease is a serious one, and often leads to tuberculosis of the lungs or other parts of the body.

2. The records from thorough removal of the nodes are better than those from their partial removal or from palliative measures.

3. The prognosis is better in children than in adults.

1. The seriousness of the disease and its liability to lead to infection of the internal organs is shown in the few available records of cases treated non-surgically, and in most of the records of cases which have been treated surgically.

Demmè, in reviewing the first twenty years' work of the Jenner Children's Hospital in Berne gives the following results from 692 patients with lymph-node tuberculosis who were treated by constitutional measures, not by surgery.

Developed tuberculosis of lungs,			145	= 21 per cent.
"	"	intestine,	24	
"	"	pia mater,	25	57 = 8.2 per cent.
"	"	kidneys,	6	
"	"	epididymis,	2	
Total,				29.2 per cent.

These records make no mention of the bone infection, nor do they tell of the lymph-nodes themselves, and, as the observation period in many instances had been short, they do not even tell the ultimate extent of the infection of the internal organs. They do, however, indicate that such infection was very frequent.

Van Noorden learned the histories of 149 patients from the Tübingen Clinic 3 to 16 years after operation, and found that 28 had died of tuberculosis and that 14 had phthisis when examined, *i.e.*, 28 per cent. in all.

Blos's Heidelberg statistics gave, among 160 cases whose histories were known 3 to 12 years after operation, 26 per cent. of lung tuberculosis and 14 per cent. of tuberculosis in other organs, *i.e.*, 40 per cent. in all, and he quotes from the records of the universities of Vienna (49 cases), Bonn (37 cases), Breslau (92 cases), Strasburg (104 cases), and Erlangen the percentage of cases who died from tuberculosis,

almost exclusively pulmonary, as respectively 10 per cent., 11 per cent., 18 per cent., 22 per cent., 26 per cent.

Finkelstein, who did not follow his cases after they left the hospital, recorded that 51 in 456, *i.e.*, 11.2 per cent., had lung tuberculosis.

Fischer has tabulated from literature the reports of 1273 cases (including many of the above), 1 to 16 years after operation, as follows: Cured, 57.65 per cent.; local recurrences, 21.84 per cent.; died, almost entirely from tuberculosis, 13.51 per cent.

These reports certainly indicate the serious nature of the disease, even granting that in some of the cases the cervical tuberculosis may have been secondary to foci in other parts of the body.

2. It is very significant that the records of long series of cases followed through many years have come almost exclusively from the clinics where operative treatment has been used, and the tendency has been continually towards thorough operation in these clinics. The observers from the seaside hospitals of Loano, Berk zur Meer, and Margate have given records of the results of the treatment for a season or for short periods; but no record of long periods of observation of the patients after leaving the hospitals has reached the writer's notice. Cazin from Berk zur Meer favors operation, and Sutcliffe and Harnett from Margate have carefully given details of operative technique and described the class of patients to whom they should be applied.

In almost all the clinic reports reference is made to the use of constitutional treatment, injection of various substances, and different kinds of local treatment; but these have been tried to test their value, and the main reliance is placed on operations. The most definite statistics concerning the different kinds of operation which I find are those of Wohlgemuth. He divides his cases into those treated without operation, those treated by incision and curetting, and those treated by extirpation, as follows:

	Cured.		Improved.		Unimproved.		
	No.	Per cent.	No.	Per cent.	No.	Per cent.	Total.
No operation	11	24	17	37	18	39	46
Incision and curetting........	23	63	10	27.7	3	8.3	36
Extirpation.................	32	70.5	10	22.8	3	6.4	45
Total..............	66	51.5	37	29.5	24	19	127

Other observers do not divide their cases so definitely, the operations in each series having usually been done by several men whose methods of operation have varied. There are, however, in the reports many statements which indicate the preference of the reporter, *e.g.*, Blos states that cases treated by excision did much better than those treated by incision, and that patients treated in the latter way almost always came to the radical operation. Among his 76 cured cases there was not a single one whose only operation had been an incision, although there had been 108 " incisions" among the 429 operations in his entire series of cases.

Sutcliffe advises a thorough removal of the glands in all cases which are operated upon.

Grünfeld, who records treatment of 32 cases locally and constitutionally, 25 cases by curettement, and 125 cases by total extirpation, advises the latter as the most certain method, leading to improvement even in those patients who are not cured.

D'Arcy Power advocates thorough and early removal before caseation has taken place.

Karewski, who has operated on over 250 cases, including those reported by Wohlgemuth, and had made a careful trial of various methods of treatment, strongly advocates thorough removal by operation.

Jordan, with an experience of over 400 cases, some of them tabulated by Blos, treated by operations of various kinds, strongly advocates thorough removal of the diseased nodes, and particularly emphasizes the futility of partial excision in those patients who have extensively adherent nodes, stating

that the resulting sinuses may be open for the rest of the patient's life.

Mitchell, reporting from Halsted's clinic (170 cases), advocates thorough operation.

Almost all operators of large experience advocate thorough operation, although there are differences in their conceptions of what constitutes thoroughness.

3. That the prognosis is better in children than in adults is very generally acknowledged. The statistics from Demmè and Wohlgemuth's non-operative cases in children are not favorable, but that may be believed to be due to the method of treatment. The results from Wohlgemuth's operated cases under ten years of age, from Poore's cases under fourteen years of age, and those of the writer's cases which are under fifteen years of age, are particularly favorable. Blos's cases did not give very favorable statistics, and only nine in the series were in the first decade of life. He and Schüller call particular attention to the much better prognosis in children than in adults.

Karewski particularly emphasizes the favorable prognosis in children as compared to adults, and refers to the 128 cases under ten years of age from his clinic, which Wohlgemuth has tabulated, followed one to six years with only three deaths from tuberculosis.

DESCRIPTION OF THE OBSERVATIONS UPON WHICH THIS REPORT IS BASED.

The patients, 100 in number, have been operated upon by the writer in St. Mary's Free Hospital for Children, the General Memorial Hospital, and in private practice between December, 1893, and February, 1904. The operations have consisted of thorough removal of the nodes with the minimum disturbance of the surrounding tissues, by the method described later, differing in this respect from most of the reported observations which include patients treated by incision, by curetting, and by excision. The ages of the patients were

57 in the first decade of life, 28 in the second decade, 9 in the third, 5 in the fourth, and 1 in the fifth.

Very careful efforts have been made to follow their later histories, a nurse having visited or written to hospital cases at intervals of six months or a year, and induced many of them to report at the hospital, where they have been personally inspected by the writer and their conditions recorded. Most of the other patients have been under the continued observation of the attending physician or of the writer. The examinations were made by the writer in 62 cases; by another physician in 14 cases; by a nurse in 6 cases; the report was made by the patient or a relative in 6 cases; 12 patients were not seen after leaving the hospital. Thirty-six of the patients were the subject of a preliminary report in this Journal in 1899. Microscopical examination of the removed nodes was made in all but eighteen of the cases, and in them the gross appearance was so characteristic of tuberculosis that the diagnosis was beyond question.

Animal inoculations were made in a few instances to study the virulence of the bacilli.

DETAILS OF THE REPORT.

We will consider in slight detail the Previous Clinical Histories, the Etiology and the Diagnosis, and in more detail the Anatomical Arrangement of the Nodes, the Technique of the Operation, and the Results.

Previous Clinical History.—The disease usually commenced insidiously, and it was impossible to learn when the nodes began to enlarge. In 38 of the obtainable histories the duration was given as less than a year, in 58 it was from one to ten years. The rapid enlargement and softening of a single node was frequently the factor which led the patient to seek surgical relief; often this node alone had been noticed, and hence the history of a rapid and short growth was given, when in reality there were many others present, and there must have been a slowly progressing growth for weeks or months. In 30

instances there were discharging sinuses when the patients first came under our observation. In 19 instances there had been previous incisions, or operations. In 47 instances the disease had become " very extensive," approaching the condition shown in Figs. 6, 7, and 12. In 21 instances both sides of the neck had become involved. There was frequently a history of a preceding pharyngitis; a large proportion of the patients applied for treatment in the late winter or in the spring, following the prevailing winter throat inflammations.

Etiology.—The majority of the patients lived in unsanitary surroundings (New York tenement houses), but at least 26 per cent. developed the disease while in very comfortable environment. Heredity seemed much less important than environment as an etiological factor.

The throat was apparently the most common portal of infection. In 86 instances (86 per cent.) the group of nodes which seemed to have been first enlarged was the one which directly receives the throat infection (Fig. 3). Many observations indicate the occasional presence of tubercle bacilli and tubercle tissue in enlarged tonsils and adenoids, *e.g.*, Lewin examined pharyngeal adenoids from 200 patients in Breslau and found tubercular infection in 10 (5 per cent.), and in grouping 905 similar observations he found records of 45 infections, *i.e.*, 5 per cent. Dieulafoy inoculated guinea-pigs from the faucial tonsils of 61 children apparently non-tubercular; in 8 instances 16.4 per cent. tuberculosis developed, and from 35 similar inoculations from the pharyngeal adenoids there were 7 tubercular infections, 20 per cent.

Coakley and others have also found tuberculosis in the faucial tonsils.

Wright, Cornet, and others have reported the finding of tubercle bacilli on healthy nasal mucous membrane. There can be no doubt that tubercle bacilli are occasionally present on or in the mucous membrane of the oropharynx, nasopharynx, and nose of persons in ordinary health.

There is also abundant evidence that the bacilli can go

through the mucous membrane and infect the lymphatics without leaving visible evidence of their transit, *e.g.*, Cornet brushed tubercle bacilli on the nasal mucous membrane of healthy animals, and later found enlarged tubercular cervical lymph-nodes with caseous spots, the mucous membrane showing no lesions.

Wright has shown a microscopical section which demonstrates a similar process in the larynx.

Goodale has shown that carmine particles pass through the mucous membrane of the tonsils, and Henderson has shown that similar absorption takes place when various powdered substances are blown on the surface of pharyngeal as well as faucial tonsils. Wright's description of this process seems to be very accurate: "The mucous membranes absorb, the lymphoid material harbors, and the lymph channels carry the tubercle bacilli."

In three instances in this series, or in the cases which the writer has since operated upon, the disease appeared in two children of the same family. In one instance a phthisical relative had spent the winter in the house a few months before. In another, one of the children had been an intimate playmate of a tubercular child. In all these six instances the first nodes involved were the upper ones of the deep cervical chain, and the probability of infection by the lodgement of bacilli in the pharynx is of course very great.

In eleven instances the submaxillary group of nodes was the first enlarged, indicating infection from the teeth or anterior part of the mouth or face. In two instances the parotid nodes were the first to show infection. In one case of neck lupus the location of the primary infection could not be determined.

Diagnosis.—The diagnosis is not always easy. It is frequently difficult to distinguish between tubercular nodes and simple hyperplastic nodes. If discharging sinuses are present, or discrete, softened nodes, or masses of nodes such as are shown in Figs. 4 and 5, or nodes smaller than these which have been steadily growing for several months, they will

Fig. 1. Hyperplastic cervical lymph-nodes which had reached an unusual size without pus formation. Diameters of largest node, 1⅝, 1⅜, and 1¼ inches.
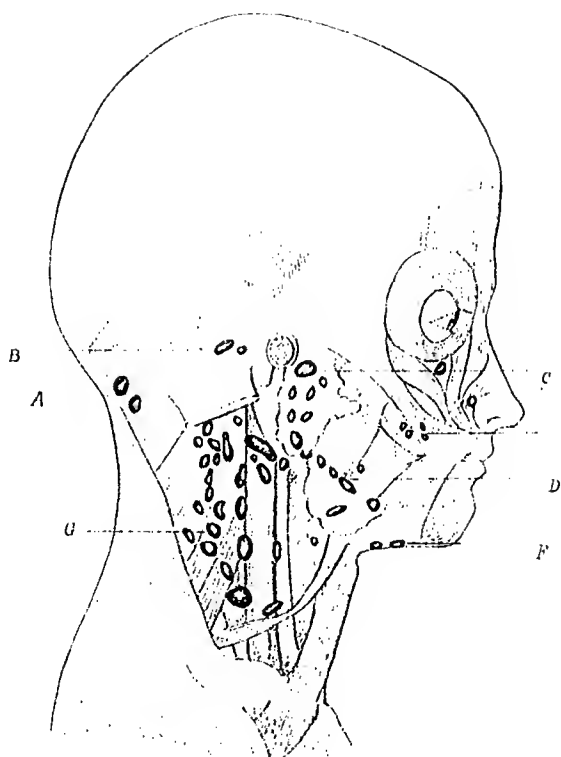
FIG. 2.—(From "The Lymphatics," Delamere, Poirier, and Cuneo.) General arrangement of the lymph-nodes in the head and neck. *A.* Occipital group; *B.* mastoid group; *C.* parotid group; *D.* submaxillary group; *F.* submental group; *G.* deep cervical chain.

usually prove to be tubercular. There are, however, many instances where hyperplastic nodes become as large as the terminal phalanx of one's thumb, alternately enlarge and diminish in size, and after months or years disappear. Fig. 1 gives the size and appearance of such nodes which had reached an unusual size, and which showed no evidence of tuberculosis on microscopical examination, nor did they recur.

In instances where the diagnosis is still doubtful after a suitable period of observation, the removal of one or more nodes for diagnosis is to be recommended; the scar need hardly be seen, and the method is surely more satisfactory than the injection of tuberculin.

Deep abscesses from acutely infected nodes, or actinomycosis, do not often give difficulties in diagnosis. Syphilis is to be borne in mind, and in doubtful cases constitutional treatment given. In lymphosarcomata the nodes usually reach a large size without becoming fluid, and they are very widely disseminated.

Branchial cysts or sinuses are usually single, and often have a distinctive location.

THE ANATOMICAL ARRANGEMENT OF THE ENLARGED NODES, which sometimes seem hopelessly complex, is really definite and reasonably simple. Fig. 2 (Poirier and Cuneo) indicates the general arrangement of the node groups in the head and neck. The deep cervical chain (G) is the general collector of the lymphatics of this region. There are five groups of nodes which receive the superficial lymphatics before they reach this central chain, the occipital, the mastoid, the parotid, the submaxillary, and the submental (see a, b, c, d, f). The latter two may also receive infection from the teeth, gums, and anterior part of the mouth.

Only in exceptional cases are any of these five groups primarily involved in tubercular inflammation. Fig. 5 shows the appearance of such involvement.

The main interest centres in the deep cervical chain, particularly in the upper nodes of this chain, which receive, either directly or through the post-pharyngeal nodes, the infectious

from the pharynx, the nasal, and much of the oral mucous membranes. These upper nodes, as above stated, were apparently the first involved in 86 per cent. of these cases. The appearance of an early infection is indicated in Fig. 3. The node, *A*, is most easily felt; but the nodes, *B B*, which lie behind it under the sternocleidomastoid muscle are regularly enlarged.

Fig. 4 shows the appearance of patients with enlargement of this group. The infection spreads regularly downward along the internal jugular vein, also downward and backward towards the trapezius border and the base of the neck, as shown in Fig. 3. When the infection is widely disseminated, the submaxillary and submental groups usually become secondarily involved. The involvement of the lungs has already been referred to. The existence of a single enlarged node in this central chain is evidence that others exist, and whenever one is removed, the region under the sternocleidomastoid muscle should be explored as a routine procedure.

THE DESCRIPTION OF THE OPERATION may be given under the following headings:

1. Incisions. 2. Structures which are to be removed and structures which are to be avoided. 3. Details as to time, method of wound treatment, etc.

1. *Incisions.*—The arrangement of incisions is very important: the fear of disfiguring scars leads many to postpone operation until the most favorable time has passed, or even until tuberculosis has invaded other organs. Unsightly scars can almost always be avoided by due attention to the anatomical arrangement of the enlarged nodes and by avoiding longitudinal incisions in prominent places. Longitudinal neck scars stretch and frequently thicken. Transverse scars which follow the curves of the neck-creases do not stretch, and after a little time are hardly to be seen, a fact to which Kocher called attention many years ago, and which is continually being verified.

One frequently sees on the same neck longitudinal scars which are broad, thick, and prominent; while the transverse
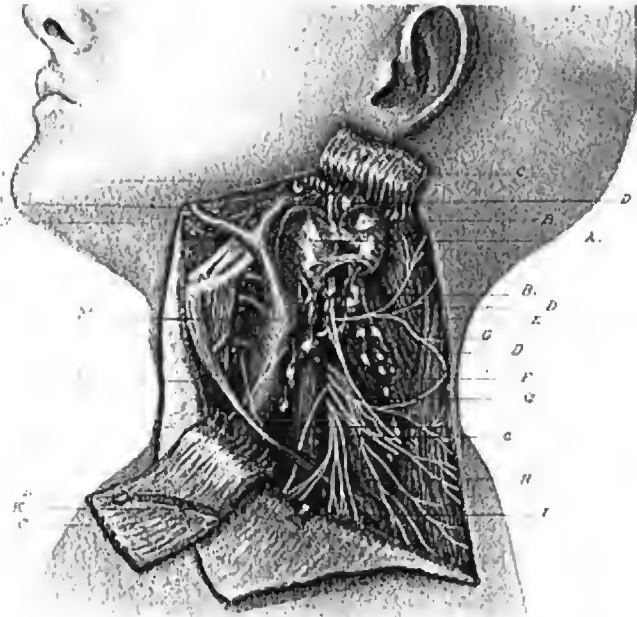
FIG. 3.—Early tubercular infection of the deep cervical chain. *A.* Most prominent caseous node; *BB.* caseous nodes under sternomastoid muscle; *CC.* sternomastoid muscle; *DDDD.* spinal accessory nerve; *E.* trapezius muscle; *F.* Levator anguli scapulæ muscle; *GGG.* branches of cervical plexus; *H.* scalenus posticus muscle; *I.* external jugular vein; *K.* course of posterior branch of spinal accessory nerve cut from sternomastoid muscle; *L.* omohyoid muscle; *M.* internal jugular vein; *N.* facial vein; *O.* posterior facial vein (anterior division of temporomaxillary); *P.* parotid gland.

FIG. 4.—Photographs of patients with tubercular infection of the deep cervical chain of lymph-nodes. Nos. 1 and 2 show early infection; No. 3, abscess formation; and No. 4, inflammation of the lower as well as the upper part of the chain.

FIG. 5.—Photographs of patients with tubercular inflammation of, 1. submaxillary; 2. submental; 3 and 4. parotid groups of lymph-nodes.

FIG. 6.—A neglected case.

FIG. 7.—Extensive tubercular inflammation of upper and lower cervical lymph-nodes.

FIG. 8.—Incisions for removing moderately enlarged lymph-nodes. *A.* Gives access to the upper nodes of the deep cervical chain which are usually first enlarged; *B.* gives access from behind if the nodes under the sternomastoid muscle are not removed through *A.*

FIG. 9.—Two transverse incisions for removing moderately enlarged nodes.

FIG. 10.—Two incisions which give access to a large part of the neck and leave little scar above the collar-line.

Fig. 11.—Photograph of patient with incisions shown in Fig. 10; taken sixteen days after operation.

1.   2.

FIG. 12.—1. Photograph of patient fourteen days after operation; "elbow" incision, anterior part transverse; posterior part along hair margin and down to shoulder; large flap turned forward.   2. Same patient before operation, showing extensive mass of nodes.

sears which were made at the same time and treated in the same way are hardly to be distinguished from the natural neck-creases.

Therefore the incision, *A* (Fig. 8), is a very important one. Through it such a group as is shown in Fig. 3 can be approached and often removed, and after healing the scar is hardly visible. Removal of the nodes through this incision is more difficult than through a longitudinal one; but the later result is so good that it may be recommended as the primary incision in nearly all cases of moderate severity. A counter-opening back of the hair-line, *B*, is used if the upper nodes cannot be satisfactorily removed through incision, *A*. For lower nodes, another transverse incision, *C* (Fig. 9), may often be used, or this and the vertical may be joined (Fig. 10) A good exposure of a large area with little noticeable scar may thus be obtained (Fig. 11). The vertical incision is, however, to be used as little as practicable, as even here it shows the characteristic tendency to stretch and thicken. In thirty-two cases one or both of these incisions have been sufficient, and without doubt the number would have been greater if they had been used earlier.

The submaxillary group can be reached by carrying the transverse incision forward. The submental group can be reached either by carrying it still further forward or by a median vertical incision. Occasionally, in far advanced cases, the transverse incision, *A*, and the vertical incision, *B*, may be joined in a curve behind the ear, and the entire flap laid forward as described in a previous paper. Fig. 12 indicates how little the scar shows after this very extensive incision. This incision has been used twenty-four times in this series. With increased experience, it seems necessary less frequently than formerly.

A very careful study has been made of the results of the incisions in these 100 cases, as well as in many cases which have been treated by other operators and others which have been permitted to suppurate without operation, and I can confidently state that operation on the plans here laid down is a

scar-saving procedure. There is less disfigurement than comes from suppuration without operation, or from small incisions in separate nodes, or from those extensive operations which are made without reference to scars.

The longitudinal incision near the anterior border of the sternomastoid muscle is probably more often used than any other, and surely should be considered. It exposes the internal jugular vein well and gives easy access to the nodes along its course, and on that account is probably the safest form of incision. It is, however, a disfiguring incision; a few months after operation the scar will usually be one-quarter of an inch wide or more, and it is in the most prominent part of the neck. This incision does not give access to the submaxillary or submental groups, nor to the posterior cervical nodes, hence additional incisions are needed for them. It should not be joined by the submaxillary incision when both are used, as the angular flap is apt to retract and leave a particularly noticeable scar.

Dollinger has reported 100 cases in whom he has removed the nodes through a vertical posterior incision alone, but most surgeons prefer some kind of an anterior incision, excepting in a few patients with long, thin necks, and non-adherent nodes.

2. *Structures which are to be Removed and Structures which are to be Avoided.*—The removal of the nodes *en masse*, together with the surrounding tissue, as though they were cancerous, is to be avoided. Important structures are injured by this procedure, although technically it appears to the operator. The removal of all the tubercular nodes is to be desired, and only so much of the adjacent tissue as is distinctly infiltrated with tubercular inflammation.

There are three structures which are particularly to be protected: the internal jugular vein, the spinal accessory nerve, and the lower fibres of the facial nerve. There are other structures which are to be heeded, but which are either less important or less likely to be injured, *e.g.*, the sternocleidomastoid muscle, the thoracic duct, the phrenic nerve, the

pneumogastric nerve, the hypoglossal nerve, the branches of the cervical plexus.

The internal jugular vein is freely exposed in almost every operation and the nodes are sometimes densely adherent to it. Traction on the nodes sometimes flattens the vein so that its margin looks like the fibrous tissue about the node capsule, and in this condition it is incised or torn. More often, however, a branch of the main vein is first injured, and in the effort to control the hæmorrhage the vein itself is clamped and torn. The posterior facial in its course from the external jugular to the anterior facial is particularly exposed to injury. The veins from the pharyngeal plexus, too, are easily injured, and, as they empty directly into the internal jugular and have no valves, bleeding from them may be very free. When, therefore, severe venous bleeding occurs in the course of an operation, it is usually best to pack the bleeding spot with gauze and turn to another part of the wound. If the hæmorrhage has been from one of the small branches, it will usually have ceased, or be so slight as to be easily controlled when the pressure is removed. If it is from the posterior or common facial, a ligature can usually be applied without injuring the internal jugular. If it is from the internal jugular itself, a running suture of fine catgut may be taken through the vein wall about the injured spot, or a lateral ligature may be applied, or the vein may be ligated above and below. In this series of cases it has been ligated five times with no ill effect. Some operators ligate it much more frequently; it is generally believed to be a harmless procedure. At least three fatal cases have been reported, however (Lenser, Kummer, Rohrbach). In two of them the remaining internal jugular was narrow, in the other it is believed to have been compressed by the bandage. Although there is seldom any ill effect from ligating one vein, one will be careful about ligating it on remembering that the tubercular nodes frequently come on both sides, and that the ligation of the second vein may be serious. Baldwin, however, reports ligating both at one operation without ill effect.

The Spinal Accessory Nerve.—This nerve is particularly exposed to injury. Between the stylomastoid foramen and its entrance into the sternomastoid muscle (Fig. 4), it usually lies between the enlarged nodes, so that if they were taken out *en masse* it must be divided. In this locality it is often flattened out, closely resembling gland capsule, and very great care is necessary to avoid it in the very locality where the nodes are most often infected. Between the sternomastoid muscle and the trapezius it is also in an exposed position, and closely resembles some of the branches of the cervical plexus. Nodes are often matted closely together in this region, too, and they should be dissected away with the utmost care. The division of this nerve is followed by an awkward drooping and weakness of the shoulder, with atrophy of the trapezius or sternocleidomastoid, or both, according to the place of division. If the ends of the nerve fail to unite, as sometimes happens, the deformity is permanent. Bailey cites a case of very serious disability from division of this nerve.

The Lower Fibres of the Facial Nerve (Ramus anastomoticus collo-mandibularis Jaffé). An unsightly paralysis of the lower lip sometimes follows incisions in the neck below the border of the jaw. It is usually temporary, but Fig. 13, 1, shows an instance in which it is permanent, following an operation which was done in Italy more than ten years ago. Fig. 13, 2, shows an instance less marked in which it was caused by pressure of the growth, not by operation, since no operation had been done. The muscle depressor labii inferioris (quadratus menti) is the chief factor in this paralysis; the nerve filament which supplies this muscle is marked *B* in Fig. 14, a drawing from a dissection made by Mr. Draper, of the College of Physicians and Surgeons. The subject has been very carefully worked out by Jaffé, also by Frohse and Bockenheimer. The former has made many dissections of this nerve twig, and has found that it sometimes accompanies the cervical filaments of the nerve three-quarters of ·an inch or even more below the angle of the jaw before turning upward and forward. Both Frohse and Bockenheimer call attention

FIG. 13.—1. Paralysis of depressor labii inferioris from section of lower filament of facial nerve more than ten years ago. 2. Partial paralysis of same muscle from pressure of enlarged nodes; no operation.
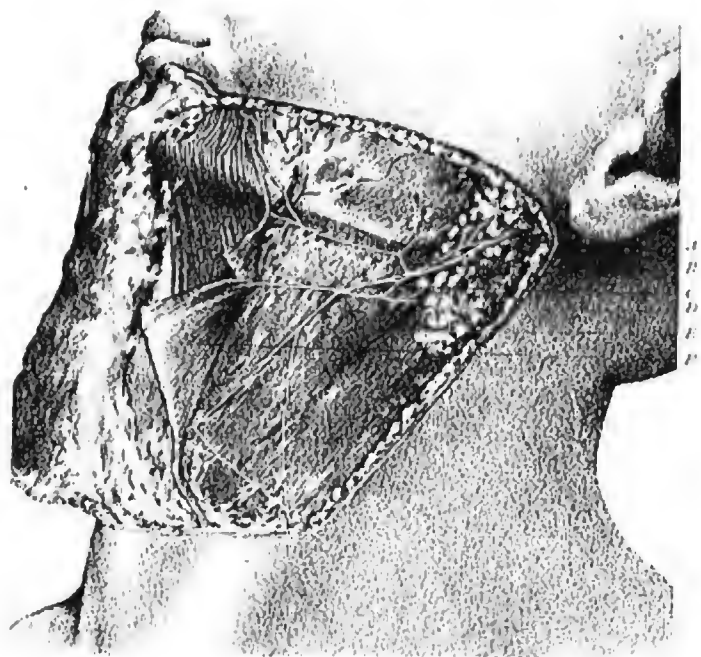
FIG. 14.—Dissection showing lower filaments of the facial nerve, especially the " Ramus anastomaticus collomandibularis," Jaffé, which supplies the depressor labii inferioris. *A,* Cervico-facial division of the facial nerve ; *B,* ramus anastomaticus collomandibularis ; *C,* filament to platysma myoides ; *D,* parotid gland ; *E,* deep cervical fascia ; *F,* platysma myoides.

not only to the variations in this nerve twig itself, but to variations in the nerve supply of the lip muscles. It seems to be well established, however, that the depressor anguli oris (triangularis menti) receives a filament from middle branch (ramus maximus) of the facial, and hence does not take part in the paralysis; also that the platysma, whose fibres blend with both the quadratus and triangularis menti, has an influence, but only a slight one. During the past year the writer has made a very careful study of the lip muscles in the cases which have come back for observation, and has only found one marked paralysis, that in a patient for whom multiple operations had been done extending over a period of years. There has been a temporary slight paralysis in many instances. The following rules for avoiding this nerve filament may be given:

1. Transverse incisions three-quarters of an inch below the angle of the jaw seldom touch it, especially if the skin is retracted downward and the incision made through the platysma and deep cervical fascia at a little lower level.

2. Since it crosses the border of the jaw with the facial artery, incisions made in front of that artery do not touch it.

3. Since it goes into the neck at about the anterior border of the sternomastoid muscle, longitudinal incisions half an inch back of that border do not touch it.

4. Since it lies on the deep cervical fascia and below the platysma, dissections between these structures should be avoided; incisions should be made through them below the level of the skin incision, and they should be retracted upward with the filament between them.

Careful adjustment of the fascia should be made at the end of the operation, so as to favor repair if any injury has taken place.

The *Sternomastoid Muscle* need not often be divided. Occasionally the nodes cannot well be removed without it, but it is far better to leave it intact if possible. In this series of cases it was divided sixteen times, much less frequently in the later than in the earlier cases. Usually, it has been divided above the insertion of the nerve; in a few instances below the

exit of the nerve. If the case heals primarily a good muscle
results, but usually it is for the removal of extensive, adher-
ent, broken-down nodes that its section is necessary, and these
are just the cases which heal slowly and leave a depression at
the point of healing. The writer has never seen disability or
torticollis follow its division.

Injury to the *Thoracic Duct* or one of its branches has
been recorded, a rare incident, since tubercular nodes are not
often found in its vicinity. Cushing, Schroeder and Plimmer,
and Jordan have recorded or compiled fourteen such instances,
five of them in operations for tubercular lymph-nodes. There
was no serious result in any instance, the single fatality being
due to other causes. Six of the cases were treated by packing,
six by ligation, and two by suture.

The writer has seen a fifteenth case treated by another
surgeon by ligation without ill effect. As treatment, Cushing
recommends suture if possible; if not, the passing of a pro-
visional ligature, which may be tightened if the packing does
not control the oozing of chyle.

Brinton (Jordan) has shown a preparation in which the
duct divided into four twigs, which reunited just before reach-
ing the innominate vein, and anatomists tell of numerous
variations in this vessel, a division and reunion of the duct
being considered normal by some.

It is probable that in some of the above-mentioned cases
branches of the duct, and not the main channel, have been
injured.

There is hardly a possibility of injuring the phrenic,
pneumogastric, sympathetic, or hypoglossal nerves if one
keeps close to the capsules of the nodes. The superficial
branches of the cervical plexus may easily be injured; this,
however, results in nothing more important than an area of
temporary anæsthesia. As has been mentioned, however, one
should be careful not to mistake the lower portion of the spinal
accessory nerve for one of these branches, and thus cut it.

3. *Details as to Time, Method of Wound Treatment, etc.*
—The operation is essentially slow and tedious. König states
that the surgeon who undertakes it should have " iron pa-

tience and plenty of time." The dissection should be carried on with the utmost care, so that no infected nodes need be left behind.

In a child under twelve years of age, it is seldom wise to continue the operation for more than an hour at one time. Older patients show no ill effects from much longer operations; two or even three hours. Finkelstein's record of five hours, however, seems excessive.

Irrigation of the wound with normal salt solution or a 1 to 5000 mercuric bichloride solution seems desirable. I have seen no advantage follow the stronger solutions which are sometimes advised.

Drainage is advisable as a routine measure on account of the increased lymph flow which often follows the section of the lymph vessels. It should, however, be small; a few strands of silkworm gut run under the sternomastoid muscle, and usually brought out through a posterior or inferior opening and tied like a seton. I have never seen a deep phlegmon in a wound drained in this way. The serum, lymph, and blood are quickly carried into the dressing and healing is prompt.

The incisions themselves may almost always be closed at once, excepting for the spots through which the silkworm gut runs. No outside stitch-holes should be made on account of the scars, but, after sewing the divided fascia with catgut, interrupted subcuticular catgut stitches may be taken about half an inch apart.

The *dressing*, which should be bulky, and moist in infected cases, should be changed often enough to keep the wound well drained, usually daily at first.

It may not be amiss to deprecate a far too common lack of supervision when this operation is delegated to inexperienced members of hospital staffs. The writer has known of two such instances where the dissection was followed up for so long a period that the patients never rallied from the operation, and has just seen a third, which was done eight months ago, where there is an extensive recurrence in groups of nodes which were not reached; an ugly, thick, longitudinal scar

where the incision was made; a paralysis from division of the spinal accessory nerve which makes it almost impossible for the patient to get on her jacket, and a lip paralysis which is very annoying, all four of which occurrences happen to be avoidable.

RESULTS.

Early.—There was no fatality from the operation and no serious complication in the entire series of 100 cases, nor in the thirty-four additional cases which the writer has since operated upon. This indication of the safety of the operation has been excelled by other operators, *e.g.*, Jordan, Wohlgemuth, and Blos report respectively 429, 167, and 328 cases without operation mortality, and Finkelstein reports 160 cases with one death. There was no mortality in seven of the ten series of cases which Blos reviews. Fatalities, however, are occasionally heard of, usually following greatly prolonged operations.

Healing was complete in all but four cases at the time of the last reported observation. Two of these had lupus spots which were not completely healed, one was transferred to another hospital on account of diphtheria, and one was removed by his parents while doing well. Aside from these, there are records of 164 operations on the remaining 96 patients, with healing in the first month in 109 instances, in the second month in 43 instances, in the third month in 10 instances, at a later time in 2 instances.

Severe œdema of the face was not noticed in any case; slight temporary œdema was present in about half a dozen cases. There was no evidence that operation disseminated the tubercular infection, but, on the other hand, very strong evidence that it prevented such dissemination.

The patients were almost always out of bed in two to four days and suffered little discomfort while wearing the bandages. The healing in the simple cases was usually complete by the tenth day.

Later Results.—The particular information which is desired concerning the later history of these patients is (1) how many develop pulmonary tuberculosis; (2) how many de-

velop tuberculosis in other parts of the body; (3) how many have recurrences in the lymph-nodes; (4) what is the general health, and (5) what is the appearance of the neck?

1. In the entire list only one patient has been found to have pulmonary tuberculosis. This patient, aged 29 years, was operated on in January, 1900, for nodes involving the deep cervical chain of the left side. March, 1902, she was found to have extensively enlarged nodes on the other side of the neck; also in the submaxillary region on the side originally operated upon. The site of the original operation was free. She refused another operation. In April, 1904, she was found to have phthisis. In the meantime she had married and undergone the strain of pregnancy, parturition, and lactation.

2. One child developed double tubercular hip disease, which is quiescent, but for which she is still wearing a brace; one developed tuberculosis of the spine, from which she died. Our patient, an adult, developed tuberculosis of the cranial bones.

This showing of only one case of phthisis and three cases of bone disease in the entire series is most encouraging. It indicates the advantage of immediate, thorough operation, the good prognosis which children offer, and the position of the operation as one of the most satisfactory in surgery.

3. The study of lymph-node recurrences brings up a question of definition as to what constitutes a recurrence. It is the rule that patients seen a year after operation show hard nodes on the same side of the neck, usually about the size of beans, sometimes a little larger, sometimes smaller. It is also the rule that these nodes either diminish or remain quiescent. The following cases illustrate this point:

No. 1, aged twenty years; operation, December, 1893, about thirty nodes removed from right side of neck; February 26, 1894, other nodes removed from same side just above clavicle. Two years later there were a few bean-sized nodes in neck and in axilla several filbert-sized nodes. Operation advised and refused. Seen January, 1903. No palpable nodes in neck, and in axilla only one pea-sized node could be felt.

Case 16, boy, aged thirteen years, had a group of tubercular nodes removed from the right side of neck, December 20, 1896.

About eight months later there were bean-sized nodes below and behind the scar, and much larger ones in the left side of neck. Operation advised, but refused. Seen January, 1903, and May, 1904. In vigorous health, with no palpable neck nodes.

Case 91, aged three years. Many tubercular nodes removed from left side of neck, June 1, 1903; December 1, 1904, several filbert-sized nodes on both sides of neck. Removed. Microscopic examination; no tubercle after very careful search.

These cases are cited as examples of a condition which is not infrequent. There have been at least twelve similar ones in the series. The nodes were manifestly hyperplastic, not true recurrences. One must agree with Van Noorden that these small, hard, postoperative nodules cannot be regarded as recurrences. Volland, on examining large numbers of school children in ordinary health, found that more than 90 per cent. of them had nodules similar to these.

On the other hand, one can hardly say when any case is really cured; Van Noorden and Blos put the time limit at six years, but the writer has seen one exceptional case of recurrence below the old incision aften ten years of quiescence. In this series, therefore, those cases who have a few hard nodes in the neck which are apparently quiescent are classed as *apparently cured*.

Hard, apparently quiescent filbert-sized nodules are classed as *uncertain*.

The cases may be best studied in groups according to period of observation, the long observed cases being manifestly the more important.

Group I.—Nineteen cases followed six to eleven years.

Fifteen were apparently in perfect health without palpable nodes or with a few not larger than beans.

One whose neck was well, still wore a brace for tubercular coxitis.

One had a small area of lupus on neck.

One had three or four filbert-sized nodes which had been quiescent two years.

One whose neck is now apparently free, had a few recurrent nodes removed only two months ago.

Seven of the patients had operations during the period of observation, four of them on the other side of the neck.

Group II.—Nine patients followed into the sixth year.

Eight are apparently well and free from recurrence.

One, an adult, had nodes removed from below the site of the scar ten months after the first operation; from the other side of the neck nine months ago, and now has a recurrence near the site of the last operation.

Only two patients in this group had secondary operations; one just mentioned, the other has had repeated operations, the last one seventeen months before this report, and is now very vigorous, strong, and without apparent recurrence.

In this group reference may well be made to patient No. 22, whose operation was March 4, 1898. At that time he was a very tall, slender young man of 18, with enormous nodes in his neck, believed by friends and physician to be rapidly declining from tuberculosis. He has lived in Colorado and Utah since his operation, has never had a recurrence, has been continually in active business. He now seems in perfect health, and has recently passed his physical examination, and been granted a large life insurance policy.

Group III.—Seven patients followed into the fifth year.

Four are now apparently in perfect health.

One, apparently in perfect health now, had an operation for a recurrence on other side of neck only eight months ago.

One has a few quiescent filbert-sized submental nodes.

One has phthisis and nodes on other side of neck, site of original operation free.

Two of these patients have had recurrence below the incisions, one on the opposite side of neck.

Group IV.—Eight patients followed into the fourth year.

Six are apparently perfectly well.

One, apparently perfectly well, had an operation for a recurrence below scar one and a half years ago.

One has quiescent filbert-sized submental nodes; otherwise well.

Only one case in this group had a secondary operation.

Group V.—Thirteen patients followed into the third year.

Seven are apparently well.

Two have had operations for recurrences; respectively, one year and ten months ago.

Three have reoccurrences in neck.

One has died of tuberculosis of spine.

Group VI.—Twenty-six patients followed into the second year.

Twenty-one are apparently well.

One is now apparently well, but had secondary operation one and a quarter years ago.

One has a single filbert-sized hard node in other side of neck, a few bean-sized nodes in both sides.

Two have small lupus spots.

One has tuberculosis of skull bones.

Only two of these patients had secondary operations.

Group VII.—Six patients followed into the first year.

Five apparently well.

One died of acute endocarditis a few weeks after leaving the hospital.

Group VIII.—Twelve patients not seen after leaving hospital.

Eleven left the hospital apparently well, with healed wounds.

One was transferred to Willard Parker Hospital before wound healed.

If tabulated, the record is as follows:

TABLE SHOWING THE RESULT BY YEARS.

Period of Observation.	6 to 10 years.	6th year.	5th year.	4th year.	3d year.	2d year.
Number of Cases.	19	9	7	8	13	26
Apparently cured	15	8	4	6	7	21
Filbert-sized nodules; diagnosis doubt- ful	1	..	1	1	..	1
Recurrent nodes..................	..	1	..	..	3	..
Apparently well now, but have had re- cent operations for recurrences...	1	..	1	1	2	1
Tubercular hip, neck well...........	1	..	..	..	..	..
Lupus	1	..	..	..	..	2
Phthisis	..	..	1	..	..	..
Tuberculosis of cranium............	..	..	..	..	..	1
Died of tuberculosis of spine	..	..	..	..	1	..

Stated in percentages:

Observed over 6 years, 19 cases.   Per Cent.
    Apparently cured .... 79.
    Filbert-sized nodes, diagnosis doubtful 5.2
    Neck apparently well, but recent operations for recur-
       rence 5.2
    Neck well, but tubercular coxitis 5.2
    Lupus spot 5.2

Observed over 3 years, 43 cases.

    Apparently cured 76.7
    Filbert-sized nodes, diagnosis doubtful .... 7.
    Neck apparently well, but recent operation for recur-
       rences .... 7.
    Recurrent nodes 2.3
    Neck well, tubercular coxitis 2.3
    Lupus 2.3
    Phthisis 2.3

Observed over 1 year, 82 cases.

    Apparently cured 74.4
    Filbert-sized nodules, diagnosis doubtful .... 5.
    Apparently well now, but have had recent operation
       for recurrences 7.2
    Recurrent nodes .... 5.
    Neck well, tubercular coxitis 1.2
    Lupus 3.6
    Phthisis 1.2
    Tuberculosis of cranium 1.2
    Died from tuberculosis of spine 1.2

If we compare the adults in this group with the children, we have the following percentages:

Over 20 years of age, 14 cases.   Per Cent.
    Apparently cured 57.2
    Filbert-sized nodes, diagnosis doubtful 7.1
    Recurrent nodes 21.3
    Phthisis 7.1
    Tuberculosis of cranium 7.1

Under 20 years of age, 68 cases.

    Apparently cured 77.9
    Filbert-sized nodes, diagnosis doubtful 4.4
    Apparently well now, but have had recent operations 8.8
    Recurrent nodes 1.5
    Neck well, tubercular coxitis 1.5
    Lupus 4.4
    Died from tuberculosis of spine 1.5

It is probable that some of the patients who are classed in these tables as " apparently cured" will at a later time show further tubercular inflammation, and that some of those who now have evidences of tuberculosis will eventually be cured, but the tables represent the condition of the patients so far as it could be learned.

In view of these observations, it seems fair to make, to patients with this disease or to their friends, the assurances stated in paragraph 5 of the summary.

SUMMARY.

1. Tuberculosis of the cervical lymph-nodes is apparently due to infection received from the fauces, pharynx, or nasal mucous membrane, in the great majority of cases (86 per cent. in this series).

2. The disease shows a tendency to extend to the lungs and other internal organs. Statistics indicate that such extension occurs in one-quarter to one-half of the cases from whom the nodes are not removed.

3. Entirely apart from its tendency to infect other organs, the disease is very tedious, causes great discomfort and disability, and leaves disfiguring scars.

4. The thorough removal of the diseased nodes by operation has given better results than any other method of treatment which the writer finds recorded.

5. The records of operations justify the following assurances: (a) In favorable cases: Safety of operation (many operators reporting more than 100 cases without mortality) ; a scar which is hardly to be seen; probable confinement to bed of two or three days; the wearing of a bandage or dressing from one and a half to three weeks; freedom from recurrence in about 75 per cent., and ultimate recovery in about 90 per cent. of the cases.

(b) In the less favorable cases: safety of operation; less disfigurement from scars than discharging sinuses will cause; freedom from recurrence in 50 to 55 per cent., and ultimate cure in 70 to 75 per cent. of the cases.

6. Transverse incisions, either in the neck-creases or parallel to them, are usually to be used. They should be so placed that the fibres of the facial nerve will not be cut. A vertical incision back of the hair-line is occasionally helpful. Extensive incisions are necessary for the far advanced cases.

7. Every precaution should be taken to preserve the normal structures of the neck.

8. It is not feasible to divide the cases into groups, some suitable, others unsuitable for operation. Every case with tubercular cervical lymph-nodes should be. operated upon unless there is a particular reason to believe that the operation would not be endured.

LITERATURE.

Allbutt, Teale. Clinical Lectures on Scrofulous Neck, London, 1885.

Bailey. Operative Paralysis of Spinal Accessory Nerve. ANNALS OF SURGERY, xxxiii, p. 558, 1901.

Baldwin. Synchronous Ligation of both Internal Jugular Veins, ANNALS OF SURGERY, September, 1902.

Blos. Ueber tub. lymph. u. ihr Verhältniss zur Lungen Tuberkulose, Mittheil. aus den Grenzgebieten der Med. und Chir., Band. iv, p. 520.

Bockenheimer. Langenbeck's Archives, Band lxxii, p. 461.

Cazin. De l'Ablation des Ganglions tuberculeuses; Statistique de l'hôpital de Berck sur Mer, Bull. de la Soc. de Chirurg., Seeance du 5 Mars, 1884, p. 223.

Cornet. Demonstration von tuberculösen Drussenschwellungen nach Impfungen von Tuberkel bacillen bei Meerschweinchen, Chirurg. Congr., 1889, I. S., 138.

Cushing. Operative Wounds of the Thoracic Duct, ANNALS OF SURGERY, xxvii, p. 719.

Delamere, Poirier, and Cuneo. The Lymphatics, Trans., London, 1903.

Demmé. Bericht über die Thätigkeit des Jennerschen Kinder hospitals in Berne, 1882.

Dieulafoy. Tuberculose carrée des trois Amygdales, Semaine Méd., 1895.

Döllinger. Die subkutane entfernung tuberklösen Lymph drusen des Halses, etc., 100 Fällen, Deutsche Zeitschrift für Chirurgie, 1904.

Finkelstein. Langenbeck's Archives, lxv, p. 353.

Fischer. Krankheiten der Lymphgefässe, Lymphdrüsen und Blutgefässe. Deutsche Chirurgie, Lief., 24a, 1901.

Fränkel. Prager Zeitschrift für Heilkunde, vii, Hefte 2 and 3.

Frohse. Die oberflächlichen Nerven des Kopfes, Berlin-Prague, 1895.

Goodale. Absorption v. Fremdkorpern durch d. Gaumentonsillen, Archives für Laryngologie, Band vii, p. 90.

Grünfeld. Ehrfahrungen über die Extirpation Tuberculoser Halsdrüsen, Zeitschrift für Heilkunde (Prager), vol. viii, 1887.

Harnett. Notes on Tuberculous Diseases of Lymph-Glands in Neck, Guy's Hospital Reports, lv, 1901, p. 55.

Henderson. Archives für Laryngologie, Band viii, p. 476.

Jaffé. Isolirte Lähmung des Musculus Quadratus Menti, etc., Archiv für klin. Chir., lxvii, p. 736.

Jordan. System of Practical Surgery v. Bergmann, Bull, vol. ii, p. 61 et seq.

Karewski. Die chirurgischen Krankheiten des Kindesalters, Stuttgart, 1894, p. 168.

Krückmann. Ueber Beziehungen der Tuberculose der Halsdrüsen zu der Tonsillen, Virchow's Archiv, Band cxxxviii.

Kummer. Zent. Chir., 1899, p. 900.

Leuser. Beiträge zur klin. Chir., Band xxviii, Heft 3, p. 642.

Lewin. Annals of Otology, Rhinology, and Laryngology, vol. ix, p. 81.

Milton. One Thousand Cases of Chronically enlarged Lymphatic Glands treated by Excision, Cairo, St. Thomas's Hospital Reports, vol. xviii, 1888.

Mitchell, J. F. The Surgical Treatment of Tuberculous Cervical Adenitis, Johns Hopkins Bulletin, xiii, p. 161.

Peraire. L'Association des Chir. France, 14 Congress, 1901.

Poore. Contributions from the Surgical Service of St. Mary's Hospital for Children, New York Medical Journal, 1892.

Power, D'Arcy. Surgical Diseases of Children, London, 1897.

Rohrbach. Beiträge zur klin. Chir., Band xvii, 3.

Schroeder and Plummer. ANNALS OF SURGERY, xxviii, p. 229.

Sheldon. The Operative Treatment of Tuberculous Glands of the Neck, New York Medical Journal, September 5, 1903, p. 456.

Sutcliffe. The Operative Treatment of Tuberculous Glands of the Neck, Lancet, November 14, 1903.

Von Bergmann. Gerhardt, Handbuch du kinderkrankheiten, Band vi, Abt. i, p. 235.

v. Noorden. Ueber die operative Behandlung der Lymphdrüsen Tuberculose und deren Endresultate, Bruns' Beiträge, vi, p. 607; also Zur Lymphdrusen tuberculose, München Med. Woch., 1900, No. 4.

Wohlgemuth. Inaugural Dissertation, Berlin, 1889.

Wright, J. Problems in the Etiology, Diagnosis, and Treatment of Tuberculous Diseases of the Upper Air-Passages, Medical News, January 19, 1901; also New York Medical Journal, April 7, 1900; also New York Medical Journal, April 26, 1896.

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DRAINAGE IN DIFFUSE SEPTIC PERITONITIS.[1]

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THE term diffuse septic peritonitis as employed in this article refers to an acute septic inflammation of the peritoneum so wide-spread in extent as apparently to involve its entire surface, and which is accompanied by marked changes in the appearance of the membrane and in the quantity and quality of its fluid contents. The division of wide-spread acute peritoneal infections into two or more forms seems both cumbersome and unnecessary, as all the cases seen by me have presented the same general characteristics, varying only in degree.

This variety of peritonitis is usually due to perforation of some of the hollow viscera, with extravasation of septic material into the general peritoneal cavity. The rapidity of the process depends upon the nature of the infecting medium and upon the point at which it is released. Perforation of the stomach or duodenum is followed more rapidly by symptoms of a spreading peritonitis than a perforation of equal size taking place in the pelvic portion of the digestive tube, because gravity quickly carries the infection across the entire peritoneal cavity from top to bottom, while from the low perforations this wide-spread soiling must be brought about by the slower but no less certain agents, peristalsis and absorption.

In the class of cases under consideration the peritoneum is found everywhere deeply congested. Some portions have begun to lose their lustre, while others are already roughened and lustreless. Patches of fibrin are scattered promiscuously over the surface, and here and there may be found slight adhesions between the intestinal coils. The fluid contents of the peritoneum are usually much increased in quantity, but in some cases seen early this increase will be found to be less than the gravity of the symptoms would indicate. Serum no longer,

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the fluid will be found of varying consistency and color. At times it appears as pure pus, at others thin and of a greenish tinge. Again, and especially when less than the usual amount of fluid is found, it will be brown in color. In some cases the entire cavity seems fairly well filled. In others the fluid will be found occupying the various fossæ and the cul-de-sac.

Previous to the year 1900, the surgical treatment of diffuse septic peritonitis was attended by results which tended neither to establish it as the method of choice nor to furnish an agreeable retrospect for those of us who now " know better."

With a mortality rate approaching 100 per cent., these cases were viewed with dismay by the surgeon. Better knowledge of the etiology and pathology of the condition demanded that the patient be given the chance for life which surgery alone could offer, but the knowledge necessary to the proper application of this means of relief was acquired more slowly and at tremendous cost. Actuated by a sense of stern duty, regardless of consequences to himself or to his professional reputation, the surgeon operated upon such cases as were not actually moribund, employing the methods which at the particular time were accepted as correct, and was then compelled in most instances to watch the steady and relentless progress of the disease to a fatal termination.

During this period of discouraging experiences we gladly welcomed and eagerly adopted any suggestion as to the management of these cases which seemed rational, and which had in the experience of a trained operator proved even of slight benefit. Within a comparatively brief period the following procedures were advanced and more or less generally applied by the surgical world in the effort to conquer the dread disease.

The cleansing of the peritoneum by evisceration and dry sponging. By dry sponging without evisceration. By copious irrigation of the entire sac at the time of the operation. By continuous irrigation maintained for hours or days after operation. By more or less limited irrigation applied to the region

from which the infection originated. By simply affording an outlet for the escape of pent-up, septic fluid, making no further effort to hasten its removal.

The attempt to drain the peritoneal cavity into the intestine by introducing through a trocar large quantities of saline purgatives into the small intestine at the time of operation.

Capillary drainage by multiple or single strands of iodoform gauze, then plain gauze, then wicking, then the cigarette drains large and small, one or many.

Glass drainage-tubes, large and small, straight or crooked, inserted here and inserted there.

Rubber drainage-tubes of all sorts and sizes used with or without gauze. The wound was left wide open filled with gauze drains, was partly closed about the drains or was closed tightly with no drainage. Counteropenings for drainage were made in the loin and flank. Careful dissection of the male perineum to permit the passage of a tube into the lower pelvis was recommended. Vaginal drainage, by tube or gauze or both, also belongs to the list. Then we find ourselves attempting to drain this septic area into the already choking lymphatics of the sufferer by raising the foot of the bed and flooding the diaphragmatic or absorbent area of the peritoneum with the contained septic fluids.

The variety of methods above mentioned as well as the many opposing principles represented by them graphically portray the unsettled and dissatisfied state of the surgical mind regarding the treatment of this disorder.

In 1900, Dr. George Ryerson Fowler, of Brooklyn, published an article describing postural postoperative treatment of diffuse septic peritonitis. The article above mentioned marked a new area in the history of this disease, supported as it was by the records of nine consecutive cases which recovered. Never before had any one been able to report such a series of successes in its treatment; and, in fact, it is questionable whether so many recoveries had up to this time occurred in the practice of any one man. To most of us the description of the elevated head and trunk posture came with

telling force. We had so long and patiently tried the various exploited methods of combating diffuse septic peritonitis, with such distressingly unsatisfactory results, that the vista thus suddenly opened before us seemed too good to be true.

As has been shown by Fowler, Clark, and others, absorption takes place most rapidly from the diaphragmatic peritoneum, particularly around the central tendon of the diaphragm, and the absorbent qualities of the membrane steadily diminish from this point downward, until, in the lower pelvis, we find that a localized septic process may exist for many days without exciting much constitutional disturbance.

In view of the fact that the position advocated by Fowler accomplishes what common sense should dictate in the light of our knowledge of the physiology of the peritoneum, we wonder that its employment was not sooner urged. In our work involving the treatment of septic processes, we strive unceasingly to accomplish, as completely as possible, their localization to the part first attacked, and to provide for the products of infection the freest external drainage. The treatment of peritoneal infections offers no exception to the above general rule, and, in my judgment, the greatest advance yet made in the furtherance of this treatment is the elevation of the head and trunk, thereby draining the high and extremely dangerous area of the cavity, with its numerous mouths, large, wide open, and hungry for septic material, into the lower and safer area where absorption through lymph channels will not take place more rapidly than will the escape of the poison through well placed external drains.

The results following any method of treatment of diffuse septic peritonitis will be more or less dependent upon several factors, among which may be mentioned the nature of the infection, the resistance of the patient, and the length of time elapsing between the onset of the peritonitis and the operation. The nature of the disease will ever cause it to be classed among the most formidable of acute surgical disorders.

Believing fully that free drainage of the infected peritoneum is the essential factor in its successful treatment, I

desire to briefly describe the technique which I have employed since December, 1902, at which time a preliminary report was made.

Since the above date nineteen cases of diffuse septic peritonitis have been operated upon with seventeen recoveries and two deaths. Ten of the cases were of appendicular origin, one following perforation of a duodenal ulcer, one following perforation of a gastric ulcer, one due to rupture of the gall-bladder, two to ruptured pus-tubes, two following rupture of a suppurating ovarian cyst, and two were cases of postoperative peritonitis, one following an abdominal hysterectomy, the other following an appendectomy. Of the fatal cases one was of appendicular origin and the other due to rupture of a large suppurating ovarian cyst. These were all cases of diffuse septic peritonitis, involving, so far as could be seen, all of the peritoneal surface, characterized by the local changes described early in the paper and by the presence of symptoms of extreme gravity. No cases of peritonitis, even of a severe type which were more or less localized, are included in the list. (It may, however, be stated that during the period in which these cases were operated upon some cases of diffuse septic peritonitis were seen in which operation was refused because the patients were moribund.)

In all cases of diffuse septic peritonitis the incision should be ample, and should be made in the median line, the better to facilitate the thorough cleansing of the cavity. When the infection is due to contamination from the upper abdominal viscera, the incision will of course be made above the umbilicus.

The first step will be to find the source of the infection and to prevent further soiling of the cavity by making immediate and thorough repair of the diseased part or parts. A two-inch incision is then made in the median line just above the symphysis, and through this a large rubber tube, one to one and one-half inches in diameter, split from end to end and carrying a gauze wick, introduced to the bottom of the pelvis. In females the posterior cul-de-sac is freely opened into the vagina, the lower abdominal incision rendering its accomplishment possi-

ble in a moment, and a similar tube without the gauze wick introduced through the cul-de-sac into the vagina. The abdominal cavity is now thoroughly washed out with gallons of hot salt solution, care being taken to reach all the fossæ and areas where septic fluid may lie more or less concealed. The upper incision is then rapidly closed with through-and-through sutures. Before tying the last stitch, enough of the saline solution is introduced through a funnel to entirely fill the abdomen. The lower wound is left open, and in males an additional tube similar to the first, but without the wick, is introduced to the bottom of the pelvis alongside the first. The patient is then raised while yet on the table to the sitting posture, which is maintained while transferring him to the bed. He is placed still in the sitting posture in the bed, the head of which has been raised from twenty-four to thirty inches from the floor.

The dressings require close attention and frequent renewal, as drainage for the first few hours will be most profuse. When the solution left in the abdomen has escaped and drainage is becoming scanty, the fluid, which in males tends to accumulate in small quantities in the lower point of the pelvis, is pumped out every two hours through the plain tube, thus decreasing the demands upon the capillary drainage furnished by the mixed drain of tube and gauze. In females no such accumulation occurs, as the vaginal drains tap the lowest point of the peritoneal sac. This pumping-out process may usually be discontinued at the end of twenty-four hours. All tubes may be withdrawn, as a rule, in from five to eight days, depending upon the indications of the particular case.

For infections originating in the lower abdomen or pelvis, the incision is made below the umbilicus, extending to the symphysis. Having effectually dealt with the source of the infection, the abdomen is thoroughly flushed out, as described above, the drains placed in the same manner and the wound closed down to the tube, or tubes, never, however, so closely as to choke them. The subsequent management is exactly the same as that above detailed.

I believe that leaving in the abdominal cavity a large amount of salt solution exercises a very valuable influence, as this, owing to the elevated head and trunk posture, establishes a strong drainage current in the right direction, *i.e.*, towards the lower pelvis, where it is easily and rapidly taken care of by the ample drains provided.

The indiscriminate and promiscuous introduction of gauze or tube drains here and there in various directions throughout the cavity is considered not only as a useless but a really harmful practice. Such drains are rapidly shut in by adhesions, drain nothing, and greatly increase the danger of postoperative obstruction.

The lowest point of any cavity is the logical point to drain, and when, by posture, we insure the gravitation of the abdominal fluids to the lower pelvis, free drainage at this point is both necessary and sufficient.

As to drainage material: I have discarded all forms but two. When a capillary drain is required, the combined tube and gauze drain, consisting of a soft rubber tube at least one inch in diameter, split from end to end, and carrying a wick of iodoform gauze which fits loosely its lumen, is employed. When capillary drainage is not demanded, as, for instance, in the vaginal drains, a similar tube without the wick is used. These drains are always available, are easily introduced, conform to the shape of the drainage track, and last, but not least, they are very easily withdrawn.

Since adopting the technique above described, the mortality of this disease has in my hands been reduced from 90 per cent. to 11 per cent. approximately. Included in the list of cases reported in this article are two of diffuse, septic, postoperative peritonitis, both of which recovered. So far as I am aware, but very few recoveries have been recorded following the treatment of postoperative peritonitis by any plan, active or passive; and I wish to reaffirm a statement made in a former article upon this subject in December, 1902, that by this method of treatment these cases of postoperative peritonitis formerly considered hopeless have been transferred from the hopeless to the hopeful class.

In conclusion, I should like to emphasize the following points :

1. Operations for diffuse septic peritonitis should be made as quickly and with as little manipulation as is compatible with thoroughness.

2. Evisceration, partial or complete, greatly increases shock and the prospects of a fatal result.

3. The generous use of clean, hot water will most thoroughly cleanse the infected cavity with the least traumatism.

4. Drainage is simplified by collecting the peritoneal fluid at one point where drains may be easily placed. The elevated head and trunk posture followed by the gravitation of fluid to the lower pelvis best accomplishes this.

5. Results following the surgical treatment of diffuse septic peritonitis will be improved should each individual operator adopt some definite form of procedure in such cases, which, being well understood by operator and assistants, may be methodically, speedily, and thoroughly carried out.